Conservation of underutilized vegetables diversity in Reunion Island

Michel Roux-Cuvelier
David Teyssedre

CIRAD – UMR 53 PVBMT, Pôle de Protection des Plantes 97410 Saint Pierre - Réunion

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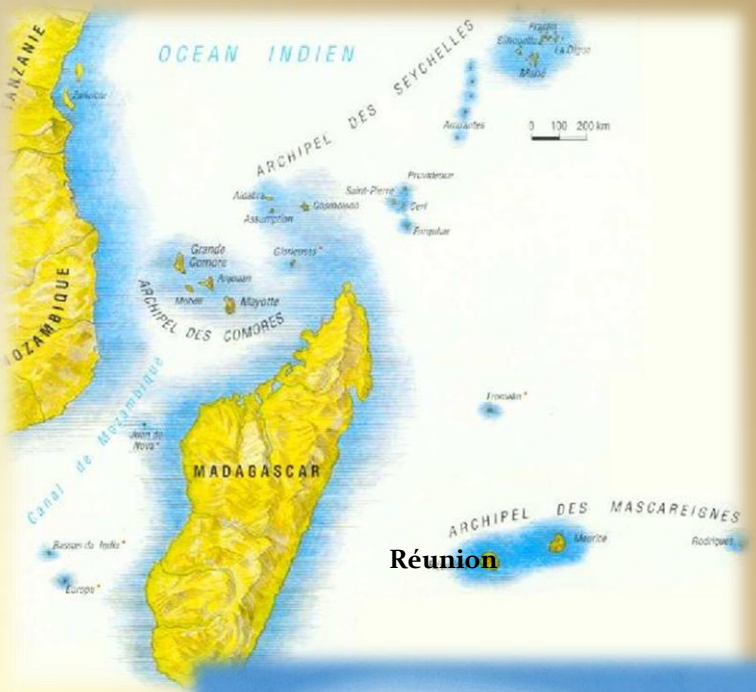
Reunion Island

- France's overseas department, Mascarene archipelago
- 9 300 km from Paris, 600 km from Madagascar
- 2 512 km², altitude from sea level to 3 069 m,
- 800 000 inhabitants
- Tropical climate
- Rainfall : from 550mm/year (West) to more than 8m (Piton de la Fournaise)
- Wide variety of microclimates



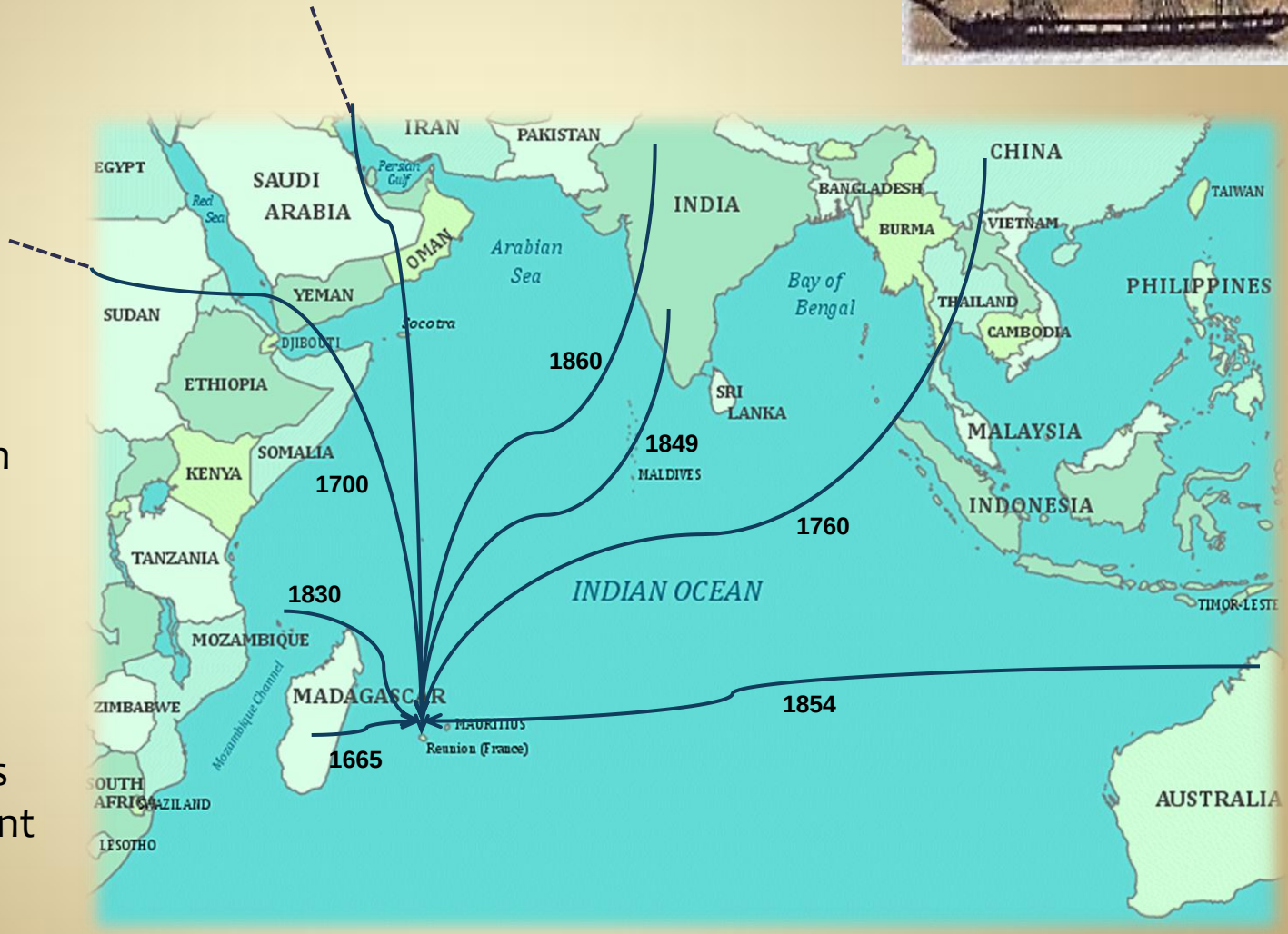
Reunion island : a recent human settlement

1642 : Arrival of the first French settlers –Bourbon Island

1848 : abolition of slavery

1849 – 1946 : French colony: more than 100 000 Indians et Africans as a new labour force

Since 1946, France's overseas department



Consequence of human settlement : the diversity of food plants in Reunion Island

From 2006, setting up of a program for identification, collection and caracterization of underutilized vegetables

23 seed crop species

7 families represented

Cucurbitaceae
Fabaceae
Moringaceae
Solanaceae
Amaranthaceae
Asteraceae
Aizoaceae

10 vegetatively propagated plant species

7 families represented

Marantaceae
Convolvulaceae
Euphorbiaceae
Araceae
Dioscoreaceae
Zingiberaceae
Canaceae

Underutilized vegetables diversity

Seed propagated crops

Cucurbitaceae family

Momordica charantia

Lagenaria siceraria

Cyclanthera pedanta

Sechium edule

Luffa acutangula et
Luffa cylindrica

Trichosenthes anguina

Underutilized vegetables diversity

Seed propagated crops

Fabaceae family

Psophocarpus tetragonolobus

Pachyrhisus erosus

Canavalia ensiformis
Canavalia gladiata

Cajanus cajan

Underutilized vegetables diversity

Seed propagated crops

Fabaceae family

Vigna unguiculata

Voandzeia subterranea

Vigna unguiculata ssp. *sesquipedalis*

Lablab purpureus

Underutilized vegetables diversity

Seed propagated crops

Leafy vegetables

Asteraceae : *Acmella oleracea*
Sonchus sp.

Amaranthaceae : *Amaranthus sp.*

Aizoaceae : *Tetragonia tetragonioides*

Solanaceae : *Solanum nigrum*

Moringaceae

- *Moringa oleifera*

Underutilized vegetables diversity

Vegetatively propagated crops

Ipomea batatas

Colocasia esculenta

Manihot esculenta

Xanthosoma sagittifolium

Underutilized vegetables diversity

Vegetatively propagated crops

Amorphophallus paeoniifolius

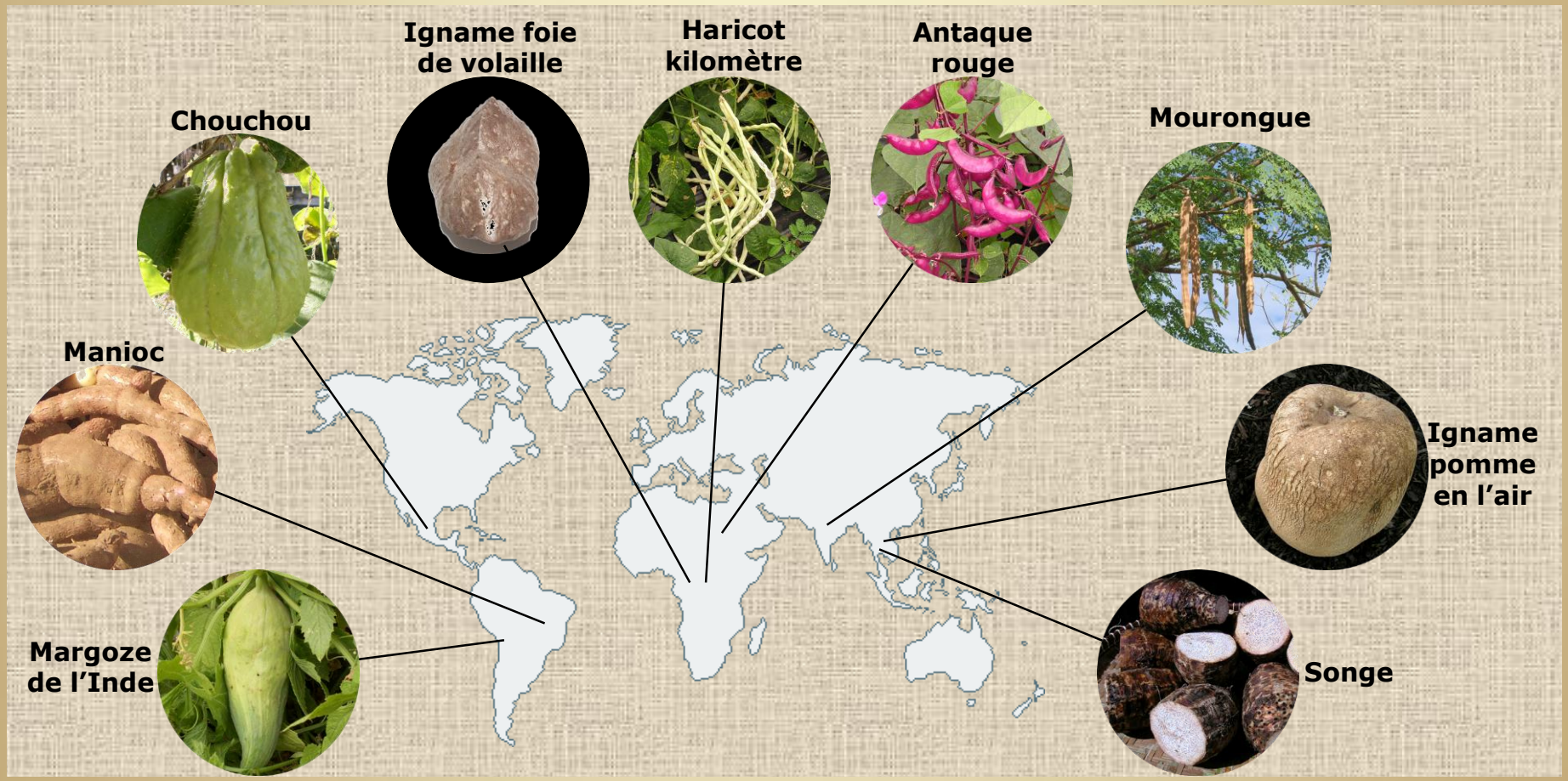
Dioscorea alata L.

Dioscorea bulbifera

Maranta arundinacea

Canna edulis

Original areas of some underutilized vegetables



Perception of underutilized vegetables in Reunion Island

Starting point: establishing an inventory with a survey of producers and consumers

Plants generally known as "légumes lontan"

Statement

Diet changes

Changing patterns of production

Changing methods of vegetable marketing

Important loss of diversity in the last 25 years

Need to preserve and develop these vegetables

Why preserve these vegetables?

The survey results show two priorities

Economic axis

Diversification of market gardening and and food producing crops

Income improvement

Patrimonial axis

Preservation of traditions

Loss of traditional knowledge

Upholding of the creole identity

How to keep these vegetables ?

Seed propagated crops

More than 250 accessions stored in cold storage at 10°C, 40% humidity

Germination tests ISTA standard → Below 70 % → Field renewal

How to keep these vegetables ?

Vegetatively propagated crops

All species must be renewed in the field every year

Very high costs for conservation

For all species

Important risk of resources loss: mainly climatic (cyclone) in Reunion Island

To secure the underutilized vegetables collection

Since 2009 the collection of underutilized vegetables has been integrated into the Biological Resources Center "Vatel"
The management of genetic resources is under Quality Assurance

Need to secure the collections

Cryopreservation of seed propagated crops

Works of C. Vertucci (1989), S. Dussert and F. Engelman, IRD (2001, 2006, 2007) show the feasibility of cryopreservation of different species of coffee and other families

For underutilized vegetable seeds : first experiment carried out by S.Dussert on a sample of 6 species in 2008

Cryoconservation of vegetable seeds

Original protocol: Dussert *et al.* (1997)

Hydric Equilibrium

Relative Humidity Temperature | controled

Saturated NH_4Cl solution

Seed moisture content
Hydration window

Cooling process

- **Direct transfert to Liquid Nitrogen**

- **Step with an intermediate temperature** "PRECOOLING"

Cryoconservation of vegetable seeds

Protocol tested

Sample : 200 seeds/species ← Germination control

Hydric equilibrium : 1 week in atmosphere with saturated salt solution (K_2CO_3) ← Germination control

Precooling : from ambient T° to – 80°C without control cooling rate ← Germination control

Immersion in Liquid Nitrogen – 196°C ← Germination control

Rewarming : tubes with seeds immersed in water at 40°C during 2' ← Germination control

Cryoconservation of vegetable seeds

First results

	Without equilibrium			With equilibrium		
Species	**Control**	**-80°C + LN**	**LN**	**Control**	**-80°C + LN**	**LN**
Lablab p.	85	30	32,5	75	52,5	50
Psophocarpus t.	87,5	92,5	85	86	97,5	75
Pachyrhizus er.	2,5	7,5	5	5	12,5	5
Voandzeia sub.	75	75	47,5	60	77,5	62,5
Lagenaria sic.	50	57,5	52,5	67,5	47,5	18
Luffa ac.	71	84	52	69	76	31
Cucurbita max.	NA	NA	NA	80	25	25
Luffa cyl.	NA	NA	NA	45	55	0
Lagenaria sic.	NA	NA	NA	80	95	25

Germination rates before and after cryopreservation

Cryoconservation of vegetable seeds

First results

	Without equilibrium			With equilibrium		
Species	**Control**	**-80°C + LN**	**LN**	**Control**	**-80°C + LN**	**LN**
Solanum mel.	17,5	40	27,5	30	40	37,5
Capsicum frut.	40	27,5	22,5	32,5	27,5	47,5
Capsicum bac.	70	72,5	29	52,5	72,5	80
Capsicum ann.	95	97,5	95	95	97,5	97,5
Zea mais cv. C414	100	97,5	100	92,5	100	90
Zea mais cv. C413	97,5	95	92,5	85	100	90
Zea mais cv. C415	100	100	100	87,5	97,5	100
Zea mais cv. Composite RUN	97,5	95	97,5	100	97,5	95
Zea mais cv. C 412	100	95	97,5	97,5	100	100

Cryoconservation of vegetable seeds

Recommandations

Standard protocol to be adapted to each studied family

Studies on the cooling speed continue in order to increase the cucurbitaceous seeds' viability after cryoconservation

Hydric equilibrium drying stage to be maintained for all species, especially for fresh seeds

Vegetatively propagated crops

First step: need to introduce all species in vitro

Protocols of cryopreservation are being developped in the framework of CRYOVEG Project

Development of underutilized vegetables diversity

The "légumes lontan"Project

Objective :

Development of a network for production, transformation and marketing to create a new range of products for restaurants, take aways and supermarkets

This integrated project involves researchers for genetic resources management, a seed farm, farmers for vegetables production, a group of supermarkets, a nutritionist doctor, some take away and restaurant managers.

Key words : diversification of vegetable production, nutritional and organoleptic quality

Project start: March 2011

Development of underutilized vegetables diversity

The Organic Farming Project

Initiative of farmers' professional organization connected with hypermarkets suppliers

Creation of a pilot farm in charge of producing references on organic production of vegetables using agroecology techniques

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